

Using PBL and Interactive Methods in Teaching Subjects in Medical Education

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ABSTRACT

Nowadays information and telecommunication technologies are becoming more and more developed. It especially attracts and captures the young - young scientists, teachers and students.

The purpose of the article is to highlight the experience of implementing problem-based learning technology in the traditional system of teaching medical disciplines. We try to analyze the impact of the training project Tempus «Introduction of innovative teaching strategies in medical education and the development of the international network of national training centers" (530519-TEMPUS-1-2012-1-UK-TEMPUS-JPCR) on the quality of teaching students of medical specialty. A problem-based learning is used as an innovative educational technology in teaching biomedical disciplines. It includes problem-based learning (PBL), team training (team-based learning - TBL), interactive lectures (interactive engagement, peer instruction with clickers), discussion, training in cooperation (collaborative learning), cooperative learning [13].

We have come to the conclusion, that development and implementation of communicative, interactive problem-based learning system, which is characterized by

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practice-oriented approach, provides a reproducible stable planned results in practical terms with the formation of skills and abilities at the beds of the patients. It also helps self-organization and increases competitiveness of a person, who is able to adapt in a rapidly developing society.

Keywords: innovative technologies, medical education, PBL (problem-based learning) implementation.

FORMULATION OF THE PROBLEM

Nowadays information and telecommunication technologies are becoming more and more developed. It especially attracts and captures the young - young scientists, teachers and students. The Internet, various gadgets and mobile devices (laptops, pads, mobile phones) can not only provide interactive communication, but also create a powerful portal for finding and sharing information. These opportunities are penetrating deeper into our lives, including the system of education.

The reform of medical education in Ukraine is based on the competency approach to the skills formation. It allows to improve the quality of education of the graduates of medical educational institutions, but it requires new approaches to the educational process [9].

Using the traditional teaching strategy - from knowledge to problems - students can not master the skills of independent learning and scientific search, because they get final learning outcomes. In this case, there is a gap between theoretical knowledge and its practical application. In most cases, a student does not understand the necessity of learning basic disciplines (anatomy, histology, physiology, etc.) and can't apply his/her knowledge in clinical practice. Consumption of "ready" scientific achievements can not form a model for future real activity in the minds of students. Therefore, in the future when they face nontrivial situation that requires implementation of their knowledge in a new field, they will not be prepared enough [13, 1, 3].

At this stage it is very important to teach students in close to real practical clinical situations, which university graduates will face in their future practice as doctors or pharmacists.

THE PURPOSE

To highlight the experience of implementing problem-based learning technology in the traditional system of teaching medical disciplines. We will also try to analyze the impact of the training project Tempus «Introduction of innovative teaching strategies in medical

education and the development of the international network of national training centers" (530519-TEMPUS-1-2012-1-UK-TEMPUS-JPCR) on the quality of teaching students of medical orientation.

Problem-based learning is used as an innovative educational technology in teaching biomedical disciplines. It includes problem-based learning (PBL), team training (team-based learning - TBL), interactive lectures (interactive engagement, peer instruction with clickers), discussion, training in cooperation (collaborative learning), cooperative learning.

BASIC MATERIAL

Problem-based learning is one of the main educational technologies used in teaching medical disciplines and biology. It is based on the system of clinical situations (cases) that gives a problematic situation to the group of students. In most cases it is not possible to explain a certain fact by using existing knowledge or perform a certain action using familiar standard methods. So it encourages students to find a new way to solve the problem. This need creates a motive, requires non-standard thinking and acting, that reflects the essence of problem-based learning. The highest level of the problem-based learning is when students during the school week set a problem themselves and solve it themselves.

The traditional system of medical education in Ukraine is based on holding lectures and practical (laboratory) classes. The central figure of this system is a teacher. Problem-based learning involves creation of problematic situations under the teacher's guidance and active independent activity of students in order to solve them, resulting in creative mastering of professional knowledge, skills and abilities. A student is the central figure of such a model of learning. The task of the teacher (tutor) is only to correct the general learning direction and coordinate students' learning activity [7, 8, 11,12].

Science blogs

It is also important to conduct scientific blogging as a process of information exchange between scientists. Scientific blogs can gradually become an alternative to articles in journals (because of the speed of delivering information to the interested specialized scientists), expand their target audience and get actual reviews minded about their operating time. Research blogs are useful and interesting for young scientists and talented students who want to develop [8, 12].

Training project Tempus

Since 2012 Medical Institute of Sumy State University (SSU) has been a member of the implementation of the training project Tempus «Introduction of innovative educational strategies in medical education and development of the International network of national training centers" (530519-TEMPUS-1-2012-1-UK-TEMPUS-JPCR). Organization of

educational process based on credit system has allowed to adapt the curriculum in a relatively short period and integrate the elements of problem-based learning in it. 1,5 year training program-based on problem-based learning technology using clinical cases (case studies) provided by University of St. George (UK), is included in the 2nd and 3rd years of studying of the students of medical institute.

"Spiral" curriculum is formed in case of problem-based learning. It allows students to return to previously acquired knowledge, deepen it and obtain new one. This approach helps to use previously obtained knowledge and skills in a new clinical situation, to offer a new way of solving the problem by combining previously known elements, and also find unique solutions, which do not have existing analogues.

The newly created pilot program started in 2014-2015 academic year. During the first year 2nd course students should master 35 linear cases, during the second year (3rd course) – 18 branched cases that have interactive character that approximates the process of learning to real clinical situations. Interactive cases have been placed in an open-source platform for creating and playing virtual patients OpenLabyrinth (<http://olab.zsmu.zp.ua/>) with separate account for tutors and students. Tutors through own account can create or edit new cases, and students may work with these cases during the second year of PBL classes.

Actually, cases are in the form of integrated multi-situational tasks (complex tests, CCT), which are common in traditional medical education. Innovation is in the way of presenting the information about a patient to students and the ways of solving a problematic clinical situation.

Lesson structure

The main components of the lesson based on the problem-based learning technology are:

- 1) updating the knowledge of the basic subjects needed for solving a clinical situation;
- 2) analysis of the problematic task by discussing it in a group and comparison of your own opinion with the views of other team members, correction of their own point of view under the influence of reasonable proofs;
- 3) giving a number of assumptions with the help of team "brainstorming" and then narrowing the search field to determine the main problem;
- 4) formulation and the logical proof of working hypotheses by constructing a chain of causation;
- 5) checking the solutions. In case of ramified cases wrong tactics require to go a few steps back and review the basic hypothesis.

By oral questioning of students and checking their knowledge we have found out that the level of students' interest to learning increased, their motivational component increased, the

final results of teaching disciplines also increased. Thus, among the questioned students 80% gave a response that they like the proposed teaching model more; it is more convenient and useful for acquiring knowledge.

At the end of the course we proposed some interactive assessment cases for students and provided real-time testing through OpenLabyrinth. Final results were stored in the database, so that tutors and researchers could analyze students' answers with statistical methods (see table 1).

Table 1

Results of online assessment of PBL students in Open Labyrinth

	Score, % (M \pm m)	Total time for test, min	Average time per question, sec
PBL students, n=32	80.41 \pm 1.87 p<0.01	29:45	31.9 \pm 4.24 p<0.05
Comparison group, n=30	64.3 \pm 4.27	39:55	48.21 \pm 5.85

Notes: p – reliability relative to comparison group using Student's test

All PBL students passed testing successfully. Average mark grew by 16% compared to students who were not involved in PBL (p<0.01). All students passed testing in allotted time, the average total time of testing is 29:45 min. that is 10 min. less than in comparison group. The average time per question (choice of answer) in PBL persons is less than in comparison group (see table 1). Most PBL students demonstrated the average time per question less than 20 sec and high final result which was about 80 points.

During the first year of the implementation of the pilot program 32 students learned on the basis of the new model, in the 2015-2016 academic year more than 60 people are studying on its basis and this process is getting widespread. Teachers have mentioned the improvement of the teaching conditions and, therefore, improvement of the students' learning results on such a streamlined basis.

Combination of the system of traditional teaching with elements of the problem-based learning is a reserve for further improvement of teaching students. Most teachers have refused to present material in the form of traditional lectures and thus have become consultants and coordinators of the educational process that allows students, working independently in small groups, to solve problems, give various hypotheses and seek the possibility of verification. The emphasis is not on memorizing and learning by heart, but on the analysis of the situation and its discussion with the active involvement of students in the process of meaningful, reasoned, conscious learning [2, 5, 6].

New requirements for teacher

So the problem-based learning has changed the role and function of the teacher. Mastering the skills of a tutor by the teachers of the Medical Institute of SSU occurred during training, conducted by the St. George University (UK), with the issuance of the certificates. It was necessary to understand that the main tasks of the teacher in terms of the problem-based learning are the following: creation of maximum positive emotions for students during the class, encouraging a student to use his intuition in combination with responsibility for decisions, stimulation of cognitive activity of students, informational supply of the educational process, monitoring of the correct direction of diagnostic search, etc.

Based on problem-based learning tasks, the new technique sets a number of requirements to the teacher: the joint search, based on the distribution of activities between students and a teacher; focus on the assessment of the possibilities of the students to determine the direction and content of the next stage of the search; tolerance to students' mistakes made while trying to find their own solutions; broad outlook, teacher's erudition.

Application of the Herbartian theory

Our own experience shows that for the organization of problem-based learning a teacher has to overcome a number of difficulties: low motivation of some students, their indecisiveness and lack of activity, inability to distinguish significant aspects of the problematic task (clinical situation), attempts to use similar algorithms to solve different types of problems.

The practical Herbartian theory of education is interesting in this context. In this theory the emphasis is placed on the didactic preparing of the teacher, his ability to think and "pedagogical tact." Thanks to J.-F. Herbart the question of "pedagogical tact" became the common heritage of pedagogical thinking and activity. In "Teaching Notes" ("Pädagogische Schriften") (1802) it was found that pedagogical tact is produced in the process of teaching practice, through the influence on our feelings. Feelings, by J.-F. Herbart, are combined through mutual understanding between students and teachers through pedagogical influence. The scientist and his followers emphasised that the success or failure of any educational efforts depend on how the teacher "produces" his tact through his thinking, considering, research and scientific quality [4, 10].

Students should be gradually accustomed to the synthesis of knowledge and its application in practice. The following will be helpful: business games, "brainstorming" analysis of micro situations with a teacher, which are widely used in the Medical Institute of SSU, both in the problem-based and traditional learning.

But for such work a teacher himself must have developed skills and experience both as a physician and educator. A necessary condition for professional growth is teacher's mandatory training abroad, which allows to get new experience, stimulate learning of foreign languages.

So the teacher must not only put a set of knowledge in the medical student, but move his process of thinking with the help of person-oriented approach to learning.

The introduction of ICT in education

Another condition for improving the quality of medical education is to introduce in the learning process new information, interactive telecommunication technologies which are widely applied in a problem-based learning.

Each class held basing on the methods of problem-based learning should be finished with a discussion of literature and resources needed to prepare for the case. As part of the Tempus project the only window of the virtual library was created on the platform of Microsoft Office 365. The portal provides access from any mobile device for all participants of the educational process (tutors, students) to educational materials that can be presented in Russian or English. In addition, the library allows you to post and use multimedia atlases, online banks of electrocardiograms, X-rays, tomograms, movies, elements of animated computer simulation in the educational process.

Remote technologies allow to get access to educational content independently from the location, help the organization of dynamic learning process. Creation of electronical educational devices(textbooks, lecture series, etc.) is important for implementation of these technologies. For this purpose an open access platform OpenCourseWare (OCW) (available at <http://ocw.sumdu.edu.ua>) was created in Sumy State University.

To create a high intensity of information flow for a limited period of airtime thanks to Lync Online it is possible to hold virtual "round tables", seminars and conferences for students and teachers. Also the device makes possible videotranslations of operations, manipulations and distance consulting of patients.

EXPANDING THIS SUBJECT

On the basis of such communication technologies (ICT), in order to attract medical students to the practical monitoring of patients, the University is creating a remote IT model in the form of automated program of patients` notice with two-way communication support. With the help of students we form information-analytical base. It has a function of reminding patients with arterial hypertension and feedback with a general practitioner of family medicine.

The proposed method of improving the quality of treatment of patients with arterial hypertension uses information-technical technologies. It allows to achieve improvement of

governance at the hospital, shortening of hospital treatment, deepening the quality of treatment and reduction of economic losses.

Thus, during the training students get involved in the implementation of information technology into the medical practice.

So information technologies help students to master knowledge faster, to operate mobile data sets and to be at the cutting edge of modern science.

Information technologies enable students to empirically explore new areas of knowledge and situationally simulate complex processes, perform calculations, get quick access to large volumes of data, process them using the methods of analysis and synthesis in order to achieve verificatory results.

Training of doctors at the transition to family and health insurance sets high demands to the knowledge of specialists. Family doctor should possess a great amount of knowledge, to be able to work with modern equipment, perform a series of manipulations, etc.

Application of knowledge and understanding, forming of judgments, communication skills and ability for lifelong learning are key competencies of the future doctor [The framework of qualifications for the European Higher Education Area [electronic resource]. - Access: http://www.ehea.info/Uploads/QF/050520_Framework_qualifications.pdf].

CONCLUSION

Problem-based learning allows you to master these competencies in the best possible way. It will allow to prepare a new generation of professionals who will perfectly master professional skills, will be able to learn constantly, grow professionally and adapt to the environment, quickly solve problems and obtain knowledge during all their professional lives.

Thus, development and implementation of the system of communicative, interactive problem-based learning, characterized by practice-oriented approach, provides a reproducible stable planned results in practical terms with the formation of skills and abilities at the beds of the patients, helps self-organization and increases competitiveness of a person, able to adapt in the conditions in society that is developing rapidly.

References

- Andrushchenko V., Bodnar V., Vasyluk A. [Modernization of Teacher Education]. Vyscha shkola [High School]. 2009: 9: 76–82. (In Ukrainian)
- Grisham J.W., Martiniuk A. LC, Joel N. [Problem-Based Learning (PBL) and Public Health: An Initial Exploration of Perceptions of PBL in Vietnam]. EP Wright. Asia-Pacific Journal of Public Health, March 2015; vol. 27, 2: pp. NP2019-NP2027., first published on February 14, 2012, p.2019-2027.
- Grudzinsky A.O. ["Group of Eight" on education]. Vysshee obrasovanie v Rossii [High Education in Russia]. 2009: 9: 66–71. (In Russian) *
- Huemer W. University of Parma, Italy, Landerer C. University of Salzburg, Austria [Mathematics, experience and laboratories: Herbart's and Brentano's role in the rise of scientific psychology]. Jorنال "History of the Human Sciences", 2010, #23(3) p.73-79.
- Idowu Y., Muir E., Easton G. [Problem-based learning case writing by students based on early years clinical attachments: a focus group evaluation]. JRSO Open, March 2016: vol. 7, p.1-8.
- Johnson M., Hayes M.J. [A comparison of problem-based and didactic learning pedagogies on an electronics engineering course]. International Journal of Electrical Engineering Education, January 2016; vol. 53, 1: pp. 3-22., first published on July 23, 2015, p.1-20.
- Kaloshin V., Gumenyuk D., Lutsenko Y. [Pedagogy of success: Theory and Practice]. Kiev, 2011: 194pp. (In Ukrainian)
- Kerawalla L, Minocha Sh, Kirkup G, Conole G [[An empirically grounded framework to guide blogging in higher education](#)]. Research in Learning Technology, Suppl.: ALT-C. 2012:176-188. (In English) **
- Kovalchuk L.Y. [Results of implementation latest techniques educational process in Ternopil state medical university and plans for the future]. Medichna osvita [Medical Education]. 2012: 2: 11-17. (In Ukrainian)
- Neumann E., Kiss A., Fejes I., Bajomi I., Berényi E., Biró Z.A., Vida J. [The Hard Work of Interpretation: The National Politics of PISA Reception in Hungary and Romania]. European Educational Research Journal, June 2012; vol. 11, 2: pp. 227-242.
- Stetsenko G [Problems introduction web technologies in higher pedagogical educational institutions]. Higher Education Pedagogy: methodology, theory and technology. Kiev: Gnosis, 2009: 630 pp.: 569 - 572. (In Ukrainian)
- Xie Y., Fengfeng K., Sharma P. [The effect of peer feedback for blogging on college students' reflective learning processes]. The Internet and Higher Education. 2008: 11: 18-25. (In English)
- Realising the European Higher Education Area [Communiqué of the Conference of European Ministers about training specialists]. Berlin, 16–19 Sep, 2003: 28–30. (In English)

Comments:

* is about applying new pedagogical strategy in Russian high education (include Medical education).

** is also an important issue is to conduct scientific blogging as a process of exchange of information and good ideas among scientists. Science blogs can gradually become an alternative to articles in journals in the context of the speed of delivering information to the interested specialized scientists, expand its target audience and getting actual reviews minded about their operating time. Research blogs are useful and interesting for the young scientist and prospective students who want to develop.